REMARKS

Favorable reconsideration of the present application is respectfully requested.

The non-elected Claims 7-13 and 20 have been canceled without prejudice. The preamble of the remaining claims has been modified in response to the objection of paragraph 3. Claims 3 and 16 have also been amended to clarify that the fuel cell and battery can cooperate to satisfy the required load.

The claimed invention is directed to a fuel cell system of the type having both fuel cells and a secondary battery for supplying a load. A system of this type is conventionally controlled in the manner described on page 2 of the present specification and illustrated in Figures 6 and 7. That is, the required output of an inverter receiving energy from the fuel cells and a battery is calculated, and the fuel cells are operated to cover the required output of the inverter. The battery outputs additional power in those cases where the output of the fuel cells is insufficient to cover the load demanded of the inverter.

The conventional prior art, however, fails to take into account the power generation efficiency and gas utilization factors of the fuel cell, which are variable depending upon the operating point of the fuel cell. According to a feature of the invention, on the other hand, a control unit or means specifies a working point associated with the output electric current-output voltage characteristic of the fuel cells corresponding to a measured gas flow rate relating quantity, and determines an amount of electric power to be taken out of the fuel cells which is required to activate the fuel cells at the specified working point. For example, referring to the non-limiting Figures 2-4, a working point may be determined for a measured gas flow rate, e.g., a working point corresponding to a maximum product of the output voltage and current. This may be point P_m which is the point of highest energy conversion efficiency (page 17, lines 11-16; step S18 of Figure 2). The output of electric power of the fuel cells at the specified working point may then be determined (step S20; page 20, lines 21-

24). The difference between the output of the fuel cells at the specified working point and that required of the inverter may then be determined at step S22, and the secondary battery supplied with, or drained of, power at steps S24-S46 based on this determination.

Claims 3 and 16 were rejected under 35 U.S.C. § 102 as being anticipated by Lorenz et al. (U.S. patent 5,646,852). However, there is no teaching in Lorenz et al. of determining an amount of electric power to be taken out of the fuel cell, which is required to activate the fuel cell at a specified working point associated with an output current/voltage characteristic of the fuel cell corresponding to a measured gas flow rate relating quantity, and to regulate the power input to, or taken from, a secondary battery, based on this determination. Instead, Lorenz et al. controls the output of the fuel cell to match the required load.

More particularly, Lorenz et al. is directed to a fuel cell working alone to provide power to a vehicle. There is no battery provided to supplement the fuel cell in satisfying a required load. The only battery mentioned in Lorenz et al. is a 12v starter battery (col. 2, lines 16-19). Lorenz et al. therefore addresses a problem unique to such systems: preventing a load that differs from the maximum current output of the fuel cell. To this end, Lorenz et al. determines the required load from the accelerator pedal position FP (column 2, lines 56-58) and controls the oxidant flow to the fuel cell so that the fuel cell output does not exceed the vehicle load (block 28). Conversely, if the required load is greater than the maximum power currently available from the fuel cell, the load requirement value is reduced to a corrected value P_{corr} which is the same as the maximum fuel cell power P_{max} (column 3, lines 11-36).

Thus Lorenz et al. does not provide the presently claimed battery which accumulates and/or outputs electric power to satisfy the load, only a starter battery. Lorenz et al. also fails to specify a working point associated with an output current/voltage characteristic of a fuel cell corresponding to a measured gas flow rate relating quantity, to determine a first

amount of electric power to be taken out of the fuel cells which is required to activate the fuel cells at the specified working point, but instead reduces the determined load requirement to equal a maximum output of the fuel cell. Since Lorenz et al. does not specify a working point for the fuel cell, one cannot select a working point having desirable characteristics such as a high energy conversion efficiency. Also, since Lorenz et al. lacks a battery for satisfying a load, it does not regulate the electric power to be output from or accumulated in such a battery. It may therefore be appreciated that the invention as now set forth in Claims 3 and 16 clearly defines over Lorenz et al.

Claims 3-6 and 16-19 were also rejected under 35 U.S.C. § 103 as being obvious over Lorenz et al. in view of Japanese patent publication 07-240212, corresponding to U.S. patent 5,631,532 (Azuma et al.). This rejection is also respectfully traversed.

Azuma et al. discloses a fuel cell system in which the fuel cell 3 is able to continuously generate power to charge the load battery 1, irrespective of the load requirements, so that the state of charge of the battery satisfies a predetermined value. The fuel cell is operated to output power at a level such that the overall efficiency of the system is between 30 and 40% in view of the level of the residual charge (col. 4, lines 19-47).

As a threshold matter, it would not have been obvious for one skilled in the art to draw a teaching from Azuma et al. for providing Lorenz et al. with a battery capable of satisfying a vehicle load. The underlying object of Lorenz et al. is to equalize the fuel cell output and vehicle load under all operating conditions (see, e.g., col. 1, lines 38-33; col. 3, lines 38-59), which obviates the need for a load battery. Indeed, a load battery could not be used in a system having the load/fuel cell output equalization feature of Lorenz et al. because it would be impossible to charge the battery or to drain the battery to satisfy a load. Thus any attempt to provide Lorenz et al. with a battery capable of satisfying a vehicle load would require gutting of the inventive load/fuel cell output equalization feature of Lorenz et al.,

which would not have been obvious to one skilled in the art. (See MPEP § 2143.01; "THE PROPOSED MODIFICATION CANNOT RENDER THE PRIOR ART UNSATISFACTORY FOR ITS INTENDED PURPOSE").

Beyond this, Azuma et al. fails to teach the features of Claims 5 and 18 that a point of highest energy conversion efficiency on the output electric current-output voltage characteristic is specified as the working point. The Office Action relies on a portion of Azuma et al. corresponding to that previously noted in the U.S. patent. However it may be appreciated that this portion of Azuma et al. merely describes that the fuel cell can be controlled to top off the battery charge in such a way that the *overall* efficiency of the entire system is controlled; maximizing the output efficiency of the fuel cell itself is not a goal in Azuma et al. and so Azuma et al. cannot suggest controlling Lorenz et al. to this end.

Applicants therefore believe that the present application is in a condition for allowance and respectfully solicit an early Notice of Allowability.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.

Robert T. Pous
Registration No. 29,099
Attorney of Record

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413-2220
(OSMMN 06/04)

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